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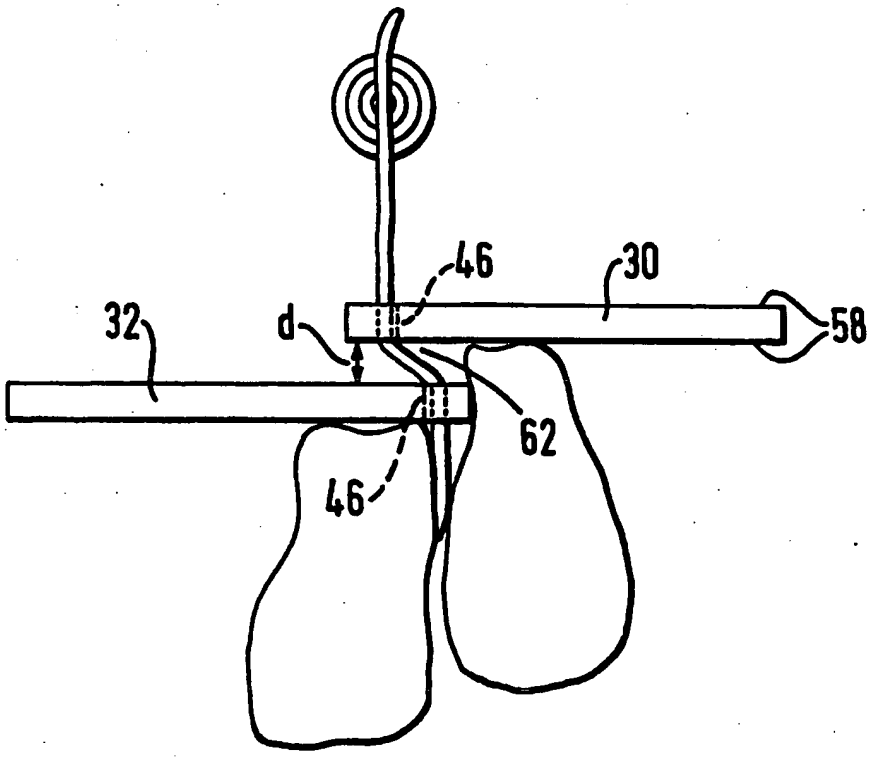
(54) Title: DEVICES FOR REMOVING SINEW

(57) Abstract

A device (6) for removing sinew (2) from a cut of meat (4) comprises gripping means (12) for gripping the sinew and scraping means (30, 32) movable relative to the gripping means to scrape the meat from the sinew. The scraping means can comprise a single blade (502), two hinged blades (500) or two separate blades (30, 32), which are arranged to approach each other to trap the sinew and remove the meat therefrom. The blades can be arranged on rotating wheels (308), or may be moved by pneumatic actuators (41, 42) or the like. A number of such devices (106) can be used side by side. The device can be used as part of a processing line (300, 400), where pieces of meat are transported to the device, the sinew is stripped from the meat, and the meat and the sinew are delivered separately. The processing line may take the form of a belt (302) or a wheel (402), and the gripping means (304, 404) may be arranged on the belt or wheel, with the blades (308, 406) arranged separately.



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# DEVICES FOR REMOVING SINEW

The present invention relates to devices and processes for removing sinew from meat.

It should be noted that in the context of this specification the term "meat" is to be construed as including products from animals such as pigs, cows, sheep, lambs etc. as well as products from poultry such as chickens and turkeys. The term "sinew" is to be construed as including tendons, ligaments or any other similar type of tissue.

The presence of sinew in meat can reduce the quantity of high quality meat which is recoverable from the animal carcass particularly during factory processing. For example, a turkey breast is made up of two muscles, both providing high quality meat. One of these muscles, anatomically known as M. pectoralis superficialis is easily removed and is sold as high quality meat. This muscle is also known as the "breast". The other muscle, anatomically known as M. pectoralis profundus, has a sinew close to the surface on one side. This latter muscle is generally referred to as the "tender". Up until now, the only satisfactory way to remove the sinew was by hand. This is obviously economically undesirable in the context of factory processing and more usually the second muscle is ground up for products such as turkey burgers or the like. The value of this second portion is consequently reduced by about 40% as compared with the other portion. This problem is not confined to the turkey tender but can be found in other types of meat product.

According to one aspect of the invention, there is provided a device for removing sinew from meat comprising means for gripping the sinew and a pair of blades engageable with said sinew for scraping the meat

therefrom, said blades when engaged being offset relative to each other to define therebetween a non-linear, for example substantially S-shaped, path for the sinew, the gripping means and the blades being movable relative to each other so as to increase the distance between the gripping means and the blades for removing the sinew from the meat.

Viewed from another aspect of the invention, there is provided a device for removing sinew from meat comprising means for clamping said sinew, and blade means arranged to scrape meat from said sinew, the gripping means and the blades being movable relative to each other to increase the distance therebetween, said blade means being shaped so as to substantially surround a portion of said sinew and the portion of said blade means in contact with said sinew being arranged to scrape meat therefrom as the distance between the blades and the gripping means is increased.

With embodiments of this invention, a substantially mechanised process can be used to remove sinew from meat. Thus portions of meat which would otherwise be ground up or minced may instead be recovered as high quality, sinew-free meat which has obvious economic advantages as the value of the meat is increased.

As will be appreciated the gripping means or the blades or both may be moved in order to increase the distance between the two parts. In one preferred embodiment, the gripping means is arranged so as to be fixed whilst the blades are mounted on a movable frame. The gripping means and/or the blades may be moved by one or more hydraulic or pneumatic cylinders, a motorized actuator or any other appropriate arrangement.

The gripping means may comprise first and second members movable relative to each other, toward and away from each other. Thus, when a sinew is to be gripped the two members are moved together, whilst to release the sinew the members are moved apart. Of course one of

the members may be fixed and the other movable or both of the members may be movable. In a preferred embodiment one of the members is fixed and provides a base or anvil against which a second, movable, member acts. It is desired that the second member be so arranged that when a sinew is in place the second member pushes against the first member with such a force that the sinew is securely gripped during the operation to remove the sinew. The second member may be pressed against the first member using any suitable actuating means for example a hydraulic cylinder, pneumatic cylinder, motor driven mechanism etc.

To improve the clamping action of the gripping means, a gripping surface of one or both of the gripping members is advantageously not smooth, for example ridged or ribbed. This ridging may take any appropriate form and may consist of concentric circular ridges, parallel ridges or a grid like arrangement. The presence of, for example, ribs or ridges increases the clamping action of the gripping means as the sinew is less likely to slip from between the two members. The gripping surfaces may of course be smooth but the presence of the ridges reduces the amount of force with which the second member needs to act against the first member in order to obtain secure clamping.

In some embodiments of the invention, the gripping means may be adapted to spin the sinew about its longitudinal axis which substantially extends in the direction in which the blades and the gripping arrangement move apart. The spinning of the sinew facilitates the removal of the meat from the sinew.

Each of the blades may have an edge which contacts the sinew when the device is in use. These edges may be smooth or serrated but should not be so sharp as to cut the sinew while the meat is being scraped off.

Preferably at least one of the blades has, on the edge contacting the sinew, a recess which will serve to

position the sinew during the scraping operation. The edges defining the or each recess preferably scrape the meat away from at least part of the outer contour of the sinew. Accordingly the or each recess preferably substantially conforms to at least part of the outer contour of the sinew to be removed. The or each recess may be of any suitable shape such as substantially semi-circular, square, triangular etc.

The or each recess may protrude outwardly with respect to the remainder of the blade edge but in more preferred embodiments is in the form of a notch. The or each recess encourages the sinew to contact the same region of the blade edge ie. the recess so that, for example, movement of the sinew perpendicular to the pulling direction, during removal of the sinew, is eliminated. If only one blade is provided with a recess, it is preferably present in the blade closer to the gripping means. In this way the meat, during the scraping operation, is substantially removed from the sinew before it passes through the recess. However it is particularly preferred that a recess is provided on each blade and that the recesses co-operate so as to define an aperture like arrangement so that the sinew is scraped around substantially all of its circumference by the edges of the recesses.

The edges of the blade, which are in contact with the sinew, may each generally define a V-shape with the apex arranged inwardly of the two sides of the V which slope outwardly from the apex. The or each recess is preferably arranged at the apex of the V-shape so that the sloping sides of the V-shape urge the sinew back into the recesses should the sinew become displaced during the operation to remove the sinew. Of course the edge of the blades in contact with the sinew may alternatively be U-shaped, linear, curved or any other suitable shape.

In order to define the non-linear, eg. S-shape path for the sinew, the blades are preferably disposed in parallel planes which are spaced apart from each other by a relatively small distance, eg. a distance comparable or slightly smaller than the thickness of the sinew. In some embodiments the distance may be between 0.5mm to 5mm or more preferably in the range of .5mm to 3mm. In one preferred embodiment of the spacing is in the region of 1mm. Some embodiments of the invention may include adjusting means in order to vary the distance between the blades, for example to accommodate different cuts of meat. Preferably however in their engaged position, at least part of the blades will overlie one another to define an S-shaped path for the sinew.

Alternatively, the blades may be arranged so as to lie flush against one another in overlapping relationship with substantially no gap therebetween. Each blade may have a groove on one of its surfaces such that the grooves are on adjacent blade surfaces and are substantially aligned so as to define the non-linear eg. S-shaped path for the sinew. Thus the sinew passes through the blades by means of the grooves. Of course a groove may be provided on only one of the blade surfaces.

The blades preferably have surfaces which are substantially flat and which lie substantially perpendicular to the direction along which the blades and gripping means are separated during the scraping operation. The surfaces of the blades, on one side, may be arranged so as to contact the meat portion which has been scraped off the sinew so as to exert a pushing action on the meat when the gripping means and the blades are moved apart. This pushing action will augment the scraping action provided by the blades and may also direct the meat for example down a chute after it has been removed from the sinew.

In the case where the edges of the blade which contact with the sinew are for example V-shaped, the blade surfaces preferably have a V-shaped or like cut-out portion. Thus if the blades are arranged to overlie one another, the sinew may in effect pass through an aperture defined by the recesses and the four sloping sides of the two V-shaped cut-out portions. The sinew will thus be surrounded by the two blades which will exert a pushing action on the meat on all sides around the sinew.

The blades are preferably arranged to be movable so that the scraping edges are moved towards and away from each other for example in a direction perpendicular to that along which the blades and gripping means are separated. Thus, when the blades are moved apart, the sinew can be easily placed between the blades. As the blades are moved together, so that the end regions of the two blades overlie one another, an S-shaped path may be defined for the sinew. The blades may be moved toward and away from each other by any conventional means such as a hydraulic cylinder, pneumatic cylinder or motorised actuating members.

In one alternative embodiment, the blades comprise two counter rotating disc members, the disc members being provided in spaced apart parallel planes in overlapping relation to one another. Preferably said rotating disc members each have a plurality of recesses, respective recesses co-operating to remove the meat from said sinew. A generally S-shaped path is preferably provided through the blades for the sinew. The rotating blades may rotate in a stepwise manner so that said blades are stationary during removal of the sinew. Thus, instead of moving the blades towards and away from each other to trap the sinew therebetween, the rotation of the blades guides the sinew to a position between the two blades. Of course, the blades may rotate during removal of the sinew. In such cases, the speed of

rotation of the blades may be such that the sinew is removed from, for example, the turkey tender as it passes through the blades. These blades may be arranged to pass through respective cleaning devices to remove pieces of meat tissue and the like from the blades. The cleaning devices may take any suitable form and are preferably positioned opposite the overlapped region of the blades. Such blades are particularly suited for continuous operation such as described below.

Other variations on the blades include an arrangement in which two blade members are hingedly connected together at one end region thereof. When the arrangement is in a closed position, the blade members are in overlapped relationship to define an S-shaped path such as described earlier. Alternatively, a single suitably shaped blade member may be provided. Such a blade member preferably has an S-shaped or the like cut-out portion into which the sinew is guided. Preferably the sinew is surrounded by the blade member on a substantial part of its circumference when in the cut-out portion. It is preferred that the sinew be removed by movement of the blade and/or gripping means in a direction which encourages the sinew to remain within the cut-out portion.

It is preferred that the sinew defines a path which is substantially linear in which it is pulled during the operation to remove the sinew from the meat. Accordingly, for example, the recesses on the blades for scraping the meat from the sinew and the clamping surfaces, when in the clamping position, of the gripping arrangement are substantially contained in that linear path. With the sinew defining a substantially linear path during the operation of the device, this has the advantage that a pulling force can be exerted on the sinew in a direction of the linear path and this force can have its maximum effect. In alternative embodiments, the pulling force may be at an angle to the

blades, such as in a continuously operating device of the type described below.

It is particularly preferred that the present invention be modified to allow continuous operation in, for example, factory conditions. In one embodiment of the invention, a rotating belt member is provided which moves past various work stations. For example the belt member may first move a first work station at which a sinew of a turkey tender or the like is gripped by suitable gripping means coupled to the belt. The gripped sinew and turkey tender may then be conveyed to a second work station where blades such as described earlier may remove the sinew from the turkey tender. In the meantime further sinew containing turkey tenders are picked up from the first work station. At a third work station, the sinew may be released by the gripping means to be received in a waste container. As will be appreciated the present invention can thus be applied to continuous operation conditions.

The rotating belt member may be rotated in a substantially horizontal plane. In this situation the plane of the blades may be arranged so as to be substantially parallel to the plane of rotation of the belt. In such cases, the spacing between the blades needs to be increased slightly as compared to arrangements where the sinew is removed by a pulling action substantially perpendicular to the blade planes. It is preferred that the blades move towards and away from each other in a direction substantially perpendicular to the direction of travel of the belt adjacent the blades. Alternatively the blades themselves can be arranged to rotate, by for example 90°, so as to adopt this position during removal of the sinew. In this way, both blades can contribute equally to the removal of the sinew.

In an alternative embodiment, the planes of the blades may be angled relative to the plane of movement

of the belt.

In a particularly preferred embodiment, the belt member rotates in a vertical plane. Thus the blades may be arranged in a position relative to the belt member such that the sinew is removed when the belt is moving in a substantially vertical direction. It has been found that the speed of the belt member can be reduced in embodiments where the belt moves in a vertical plane as compared to a horizontal plane. Of course, it is also possible that the belt member move in other planes other than those which are strictly horizontal or vertical. For example, the belt member may be moved in a plane angled to the horizontal.

In alternative embodiments, the belt member may be replaced by a rotating table which preferably moves in a horizontal plane or indeed any other suitable plane.

The belt member or rotating table may be arranged so as to operate in a stepwise manner. This is particularly suitable for those embodiments in which the movement of the blades removes the meat from the sinew. However, it is preferred that the movement of the table or belt member provides the force to remove the meat from the sinew.

According to a second aspect of the invention, there is provided a process for removing sinew from meat comprising the steps of:

gripping the sinew;

engaging a pair of blades about the sinew between the gripped portion of sinew and the meat and thereby defining a non-linear path for the sinew extending from the gripped portion to the meat; and

increasing the distance between the gripped part of the sinew and the engaged blades so the meat is scraped from the sinew by said blades.

According to a further aspect of the invention, there is provided an apparatus for removing sinew from meat in a continuous process comprising:

a plurality of gripping members for gripping a plurality of sinews at the same time;

a first work station where a sinew is initially gripped;

a second work station where the sinew is removed from said meat by a pair of blades which scrape the meat from said sinew, said blades defining a non-linear path therebetween for said sinew; and

means for moving said sinew containing meat from said first work station to said second work station whereby said second work station is substantially continuously supplied with meat containing sinew, said meat being removed from said sinew due to movement of the moving means away from said blades.

Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 shows a portion of a turkey tender through which extends a sinew;

Figure 2 is a perspective view of a first device for removing sinew;

Figure 3 is a front view of the blades of Figure 2;

Figure 4 is a view from above of part of the device of Figure 2 showing the portion of the blades when the device is in use;

Figure 5a, 5b and 5c show three different forms for one part of a sinew gripping arrangement of the device of Figure 2;

Figure 6 shows a schematic view of a second device for removing sinew;

Figure 7 is a side view of part of the device of Figure 6;

Figure 8 shows a side view of a third embodiment of the invention;

Figure 9a is a view from above of the blades of Figure 8;

Figure 9b is a cross-sectional view of the blades of Figure 9a along line IX-IX;

Figure 10 is a view from above of a fourth embodiment of the invention with the blade members in a first position;

Figure 11 is a perspective view of the apparatus of Figure 10 with the blades in a second position;

Figure 12 is a side view of an alternative embodiment of the blades;

Figure 13 shows a side view of a further alternative embodiment of a blade arrangement; and

Figure 14 shows part of a supply tray for a turkey tender.

Figure 1 show a turkey tender 2 through which a sinew 4 extends close to one surface of the muscle. The embodiments of the invention now described are arranged to remove the sinew from pieces of meat such as the tender shown in Figure 1.

One device 6 for removing sinew from meat will now be described with reference to Figures 2 to 5. The device 6 comprises a base 8 on which is mounted a first base member 10 of a gripping arrangement 12 for holding one end of a sinew. The gripping arrangement 12 also comprises a second member 14 which is movable towards and away from the first member 10 in the direction shown by arrow 16. When the first and second members 10 and 14 are in contact the sinew is gripped therebetween. The second member 14 is moved downwardly by a pneumatically operated cylinder 20 which allows the second member 14 to exert a sufficient pressure against the first member 10 in order to securely clamp a sinew.

The clamping action of the gripping arrangement 12 is enhanced by the gripping surfaces 22 and 24 of the first and second members 10 and 14. This can be seen more clearly in Figure 5 which shows three embodiments for the gripping surface 22 of the first member 10. In Figure 5a, the gripping surface 22 has a series of

concentric ridges 26 whilst in Figure 5b the surface has a series of parallel zig-zagged ribs 27. Finally in Figure 5c, the gripping surface 22 has grid-like pattern 28 on its surface. The gripping surface 24 of the second member 14 is ridged in a similar manner to that of the first.

Two blades 30 and 32 are arranged to one side of the gripping arrangement 12 and are movable toward and away from each other in the direction of arrow 34 by pneumatic cylinder 36. Pneumatic cylinder 36 has two actuating rods 38 which are both arranged to move outwardly in order to move the blades apart or inwardly to move the blades toward each other. The cylinder 36 itself is mounted on base 8. The pneumatic cylinder 36 is connected, via the actuating rods 38, to frame members 40. Each of the frame members 40 is connected to a further pneumatic actuating cylinder 41 which can move the blades in the direction of arrow 42 relative to base 8. The frame members 40 ensure that the blades 30 and 32 can only move in the directions of arrows 34 and 42 and in no other direction such as perpendicular or at an angle relative to the directions of arrows 34 or 42. Thus the blade movements can be controlled with relative accuracy.

The two blades 30 and 32 can be seen more clearly in Figures 3 and 4. The blades are generally flat with the blade edges 44 which contact the sinew being sharp enough so as to scrape away the meat from the sinew but not so sharp that the edges cut into the meat or sinew. These edges 44 each are generally V-shaped with the apex being formed by an almost semi-circular recess 46. The sinew is positioned in use so as to rest in the recesses 46 as can be seen from Figure 4. The edges of the recesses 46 are arranged so as to surround part of the sinew and it is this part of the blade edge which primarily scrapes the meat from the sinew. Should the sinew slip from the recess 46, the V-shape of the blade

edge urges the sinew back into the recess 46.

The blades 30 and 32 each have two flat opposed surfaces 58. One of the surfaces 58 of each blade is arranged to contact the meat to push it away from the sinew as can be seen from Figure 4. Due to the V-shape of the edge, the surfaces 58 are able to exert a pushing action not only on opposed sides of the sinew but rather on all sides.

The blades 30 and 32 are arranged so as to be offset relative to each other so that when the blades 30 and 32 are moved together, there is an area 62 where the two blades 30 and 32 overlie one another. The two blades 30 and 32, when overlying each other are separated by a distance d which is generally between 0.5 and 3mm. The combination of overlying and offsetting of the blades relative to one another results in a sinuous path being defined for the sinew.

The device 6 conveniently also has a downwardly extending chute 64 arranged to receive the desinewed meat from the device and pass it on for packaging, further processing etc.

The pneumatic cylinders 20, 36 and 41 of the device 6 are connected to a single pressure source 64 which is operated in response to signals from a control arrangement 66. These control signals are produced in response to operator interaction with the device eg. by the operator pressing various switches (not shown) of the device.

The operation of the device 6 will now be described. The sinew is placed on the base member 10 of the gripping arrangement 12 and the second member 14 is moved downwardly to grip the sinew by means of the pneumatic cylinder 20. The two blades 30 and 32 are moved toward each other by cylinder 36 so as to adopt the position shown in Figure 4 and define an S-like path for the sinew. The pneumatic cylinders 41 are then actuated so that the blades 30 and 32 move away from the

gripping arrangement 12 in a direction outwardly of base 8. Thus the recesses 46 of the edges 44 of the blades 30 and 32 together surround the sinew, in an offset manner, so as to scrape the meat from the sinew. The surfaces 58 of the blades 30 and 32 also have a pushing effect on the meat to further urge it away from the sinew. The blades 30 and 32 are moved in the direction away from the gripping arrangement until the sinew is completely removed from the meat. The gripping arrangement 12 remains stationary as the blades are moved outwardly. The desinewed meat drops into the chute 64 via which is removed from the device. The removed sinew is released from the gripping arrangement 12 by upward movement of the second member 14. The sinew drops down to a collecting container (not shown). The actuating rods of cylinders 41 are moved back to their initial position and the blades 30 and 32 are moved apart and the process can be repeated.

Figures 6 and 7 shows a second device 100 which operates in a similar manner to the device 6 of Figures 2 to 5 but is arranged to remove the sinew from a number of pieces of meat simultaneously. The turkey tenders are arranged in individual compartments 102 of a longitudinal tray 104. One of the longitudinal sides 106 of the tray defines a first blade member 108 which has a series of V-shaped cut-out portions 110 at the apex of each of which is a substantially semi-circular recess 112 through which the sinews extend. A second blade member 114 is arranged so as to be movable towards and away from the first blade member 108 in the direction of arrow 116 in a plane parallel to and spaced apart from the plane containing the first blade member. In one extreme position of the second blade member 114, the second blade member 114 overlaps the first blade member 108 to thereby define S-shaped paths for the sinews as shown in Figure 7. Like the first blade member 108, the second blade member 114 has a number of

V-shaped cut-out portions 118 at the apex of each of which is a recess 120. The recesses 112 and 120 will not be described in detail since they are similar to those described in the first embodiment. The second blade is arranged so that the spacing x between adjacent recesses corresponds to the spacing between adjacent recesses of the first blade member 108 so that respective recesses on the first and second blade members can cooperate to scrape the meat away from the sinews.

In this second embodiment, the gripping arrangement 124 comprises a single base element 126 for all of the sinews having a relatively smooth surface. The second member 130 of the gripping arrangement 124 is able to move downwardly in the direction of arrow 132 to act against the base member 126 to clamp the sinews. The second member 130 has a surface ridged in a similar manner to that shown in Figures 5a, 5b or 5c of the first embodiment. By having a relatively smooth surface on the base element 126, the sinews fall away more easily due to gravity as the second member 130 is moved upwardly to release the sinews. In contrast to the first embodiment, the gripping arrangement 124 of the second device 100 is arranged so as to be moved, in the direction of arrow 134, away from the tray 104 containing the pieces of meat and the blade members remain stationary.

It should be noted that, for clarity, the various components of the device for moving the blade members 108 and 114 and gripping arrangement 124 have been omitted. However, any suitable actuating mechanisms can be used such as pneumatically or hydraulically operated cylinders or motorized actuating mechanisms.

The device of Figures 6 and 7 operates in a similar manner to that of the Figures 2 to 5. In particular, the longitudinal tray compartments 102 are each loaded with a turkey tender and the sinew is arranged to extend

out of the recess 112 of each compartment. The ends of the sinews are then grasped between the base member 126 and the second member 130. The second blade member 114 is moved downwardly so that the recesses 112 and 120 of the first and second blades are in alignment and the two blade members are in overlapping relationship to define S-shape paths for the sinew. The gripping arrangement 124 is then moved away from the blade members 108 and 114 so that the recesses 112 scrape against the sinews to remove meat therefrom and the surfaces of the blade members 108 and 114 act against the meat portions. The gripping arrangement 124 is moved until the sinew is removed from the meat. The longitudinal tray of desinewed meats is then moved on for further processing and the sinews can be removed separately.

Figures 8, 9a and 9b shows a third embodiment of the invention which is particular suited to continuous operation. The device 300 has a belt member 302 to which a number of gripping members 304 for gripping the sinews of turkey tenders are attached at regular intervals. The gripping members 304 can have any suitable construction which allows the gripping and releasing of the sinew. The belt member 302 is driven in a vertical plane by two drive pulleys 306a and b, the drive motor for the drive pulleys 306a and b not being shown.

A pair of rotating blade members 308 which are shown in more detail in Figures 9a and b are provided below the leading drive pulley 306a. The two blade members 308 are arranged in parallel, spaced apart, planes and have a region 312 where there is an overlap between the blade members. The blade members 308 are rotated by a drive source (not shown) in opposite directions. Each blade member 308 has a number of cut-out portions 310 which cooperate with respective cut-out portions 310 of the other blade when in the overlapping region 312 of the blades to define an S-shaped path for

the sinew. The cut-out portions 310 can be of any suitable shape such as discussed previously. A cleaning arrangement 314 is arranged on a non-overlapping region of each blade member to remove any matter which has become caught in the cut-out portions 310.

A container 316 for receiving the desinewed turkey tenders is arranged below the rotating blades 308. Likewise a container 320 is provided for receiving the waste sinew.

Turkey tenders are delivered to the device 300 via supply station A in such a manner that they can be easily gripped by the gripping members 304.

The operation of the third embodiment 300 will now be described. As the belt member 302 moves past the turkey tender supply station A, a turkey tender is grasped by its sinew by gripping members 304. Every time a pair of gripping members 304 pass the supply station A, a turkey tender is picked up. Each turkey tender is then conveyed in turn to the rotating blade members 308. As the turkey tender approaches the blade members 308 it is drawn in by the rotary movement of the blades to the overlapping region 312 of the blades 308 and the S-shaped path for the sinew. As the gripping members 304 in question are pulled by the belt member 302 upwardly, the sinew is removed from the turkey tender. To ensure optimum operation of the device 300, the rotation speed of the blade members 308 is selected so that the sinew remains in the overlapping region until the turkey tender has been removed therefrom. The desinewed turkey tender is then dropped into container 316. The sinew itself is then released by the gripping members 304 and dropped into container 320. Continuous operation of the device 300 can thus be achieved.

In a modification to this third embodiment of the invention, the rotating blade members 308 may be operated in a stepwise manner so that when sinew is being removed from the turkey tender, the blade members

are stationary. Of course, during that time the sinew in question is trapped between the two blades. If necessary, suitable sinew detecting sensors may be provided which cause the blades to remain stationary during the sinew removing operation.

It will be appreciated, that the third embodiment may of course be arranged to remove the sinew by utilizing the horizontal motion of the device, rather than the above described vertical motion. In such circumstances, it has been found that the speed of belt needs to be increased and/or the spacing between the blade members increased by a few millimeters.

The device can of course include any other suitable blade members embodying the present invention.

A further embodiment of the invention which is also suitable for continuous operation is now described with reference to Figures 10 and 11. These figures show a device 400 which has a horizontally rotating table 402 which is driven by a drive motor (not shown) below the table. The table has a number of pairs of gripping members 404 for gripping turkey sinew. The gripping members 404 are arranged at spaced intervals around the circumferential area of the table 402. A pair of blades 406 similar to those described in relation to the first embodiment are arranged below the table surface for removing the sinew from turkey tenders. As will be described in more detail below, the blades 406 are movable towards and away from each other as well as rotatable through 90°.

The operation of the fourth device 400 will now be described. As the pairs of gripping member 404 pass a turkey tender supply station, a sinew is gripped. As a gripped sinew containing turkey tender approaches the blades 406, which are initially in the position shown in Figure 10, the blades 406 are moved toward each other to trap the sinew therebetween. The blades are then together rotated through 90° in the plane of the blades

to adopt the position shown in Figure 11. The two blades 406 thus define an S-shaped path for the sinew. As the table continues to rotate, the sinew is removed from the turkey tender and the desinewed turkey tender dropped into container 408. The blades 406 are then returned to their initial position so as to receive the sinew of the next turkey tender. The sinew itself is released and dropped into container 410. Thus, a continuous operation can be achieved.

As will be appreciated, the device can be modified so as to include any of the previously described blade and/or gripping arrangements. In certain embodiments, the table may be moved in a stepwise manner instead of the continuous operation described particularly if the blades are moved away from the table to cause removal of the meat from the sinew.

Other embodiments of the blade arrangement are also possible as illustrated in Figures 12 and 13. Both of these arrangements are particularly suited to embodiments where the gripped turkey tender is moved firstly in a direction toward the blade arrangement and, then when the sinew is engaged by the blade arrangement, in a second direction away from the blade arrangement.

Figure 12 shows the first variation where two blade members 500 are hingedly connected together, in spaced apart parallel planes in a scissor-like manner. As a sinew approaches the blade members, the blade members 500 are pivoted towards one another to grip the sinew therebetween. The blade members are so dimensioned as to define an S-shaped path for the sinew.

In the second variation shown in Figure 13, a single blade member 502 is used. As the sinew approaches the blade in the direction of arrow B, the sloping sides 504 of the blade 502 guide the sinew into the S-shaped channel 505. As the sinew is continued to be moved in the direction of arrow B, the sinew is removed from the turkey tender.

As will be appreciated, where appropriate, the various features of the above-mentioned embodiments can be interchanged. Generally it has however been found that the blade spacing should be slightly larger in embodiments where the sinew is removed by pulling in a horizontal direction as such as in the fourth embodiment.

It is preferred that the present invention be used in embodiments where the de-sinewing process can be carried out continuously. In this regard, it is useful that a constant supply of turkey tenders be supplied and that the sinew can be easily gripped. For example, a number of dissecting stations may be used to supply turkey tenders to a single conveyor. The conveyor may have shaped trays for receiving individual turkey tenders with the sinew thereof protruding for easy gripping. An example of such a tray 508 is shown in Figure 14. The direction of travel of the tray is indicated by arrow C.

Claims

1. A device for removing sinew from meat comprising means for gripping the sinew and a pair of blades engageable with the sinew for scraping the meat therefrom, said blades when engaged being offset relative to each other to define therebetween a non-linear, for example substantially S-shaped, path for the sinew, the gripping means and the blades being movable relative to each other so as to increase the distance between the gripping means and the blades for removing the sinew from the meat.

2. A device as claimed in claim 1, wherein said gripping means comprises first and second members movable relative to each other, toward and away from each other, for gripping and releasing the sinew.

3. A device as claimed in claim 1 or 2, wherein a gripping surface of one or both of said gripping members is ridged for securely gripping said sinew.

4. A device as claimed in any of claims 1 to 3, wherein at least one of said blades has, on the edge which is arranged to contact said sinew, a recess for said sinew, said recess substantially conforming to at least part of the outer contour of the sinew.

5. A device as claimed in claim 4, wherein the edges of the or each recess are arranged to scrape meat from sinew.

6. A device as claimed in claim 4 or 5, wherein the edge of at least one blade which is arranged to contact said sinew is substantially V-shaped with the recess at the apex thereof.

7. A device as claimed in any preceding claim, wherein said blades comprise two counter rotating disc members, the disc members being provided in spaced apart parallel planes in overlapping relation to one another.

8. A device as claimed in claim 7 when appended to claim 4 or 5, wherein said rotating disc members each have a plurality of said recesses, respective recesses of the two blades co-operating to remove the meat from said sinew.

9. A device as claimed in claim 8 or 9 wherein said rotating blades rotate in a stepwise manner such that said blades are stationary during removal of said sinew.

10. A device as claimed in any preceding claim wherein at least one of the blades has a surface substantially perpendicular to edges thereof defining the non-linear path, the or each surface being arranged to contact the piece of meat to push against parts of the meat when the gripping means and blades are relatively moved apart.

11. A device as claimed in any preceding claim, wherein the gripping means and the blades are arranged so that, in use, the path defined by said sinew is substantially linear.

12. A device as claimed in any preceding claim wherein the blades, in an overlapping region thereof, are separated by a distance of between .5mm and 5mm and more preferably approximately 1mm.

13. A device as claimed in any preceding claim when arranged to be used for continuous processing of meat containing sinew, said device comprising:

a plurality of gripping means for gripping a plurality of sinews substantially simultaneously;

a first work station where sinew is gripped;

a second work station where sinew is removed by said blades; and

means for moving said sinew containing meat from said first work station to said second work station, whereby said second work station is supplied substantially continuously with meat containing sinew.

14. A device as claimed in claim 13, wherein said moving means comprises a rotating endless belt.

15. A device as claimed in claim 13, wherein said moving means comprises a rotating table member.

16. A device as claimed in claim 14 or 15, wherein said blades are positioned such that sinew is removed during movement of said endless belt or table in a substantially vertical direction, said endless belt or table rotating in a substantially vertical plane.

17. Apparatus for removing sinew from meat in a continuous process comprising:

a plurality of gripping members for gripping a plurality of sinews at the same time;

a first work station where a sinew is initially gripped;

a second work station where the sinew is removed from said meat by a pair of blades which scrape the meat from said sinew, said blades defining a non-linear path therebetween for said sinew;

and means for moving said sinew containing meat from said first work station to said second work station whereby said second work station is substantially continuously supplied with meat containing sinew, said meat being removed from said sinew due to movement of the moving means away from said blades.

18. A process for removing sinew from meat comprising the steps of:

gripping the sinew;

engaging a pair of blades about the sinew between the gripped portion of sinew and the meat and thereby defining a non-linear path for the sinew extending from the gripped portion to the meat with said blades; and

increasing the distance between the gripped part of the sinew and the engaged blades so the meat is scraped from the sinew by said blades.

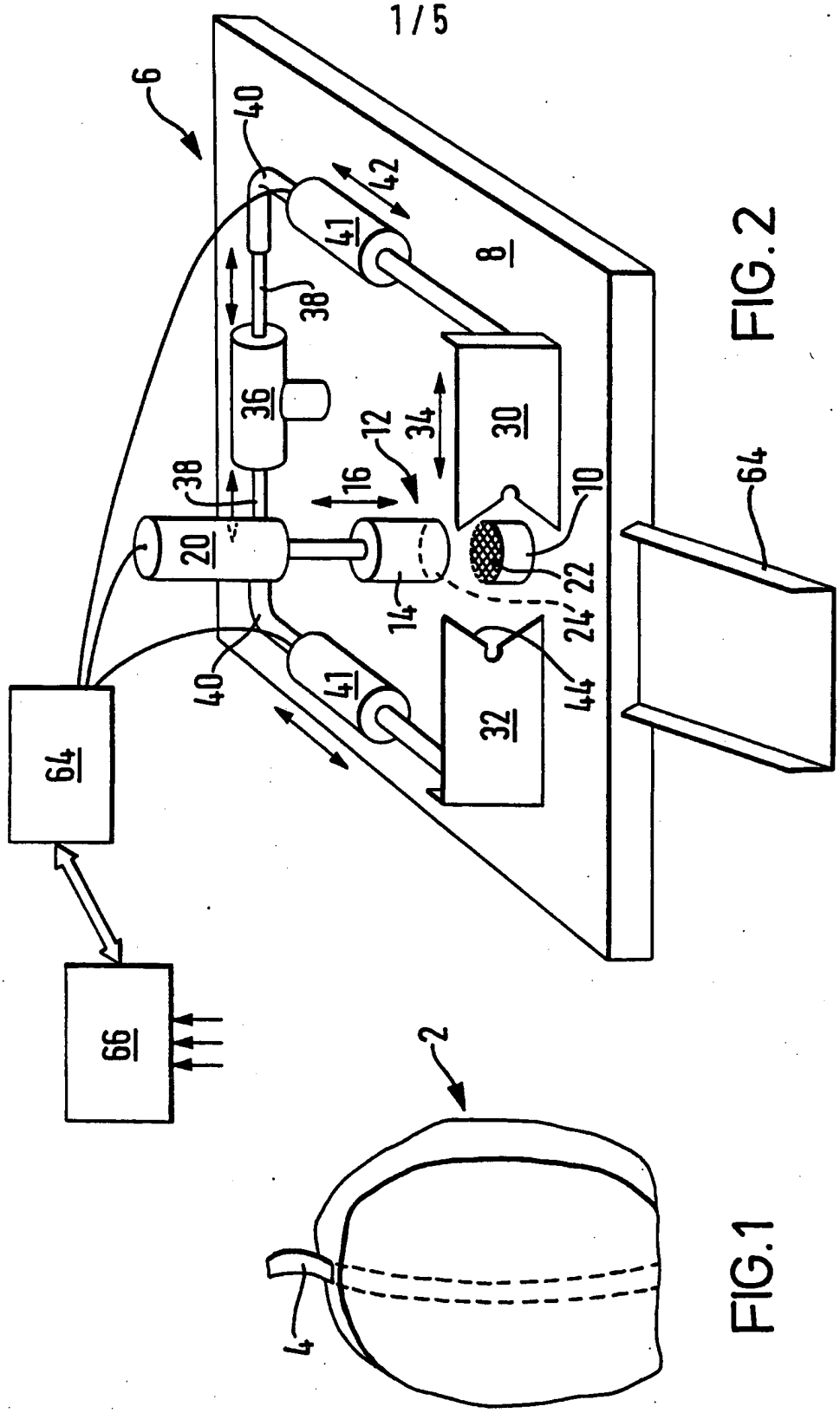



FIG.2

FIG.1

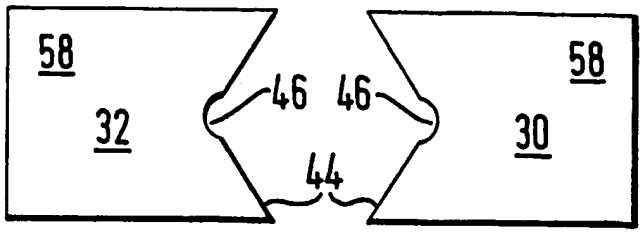



FIG.3

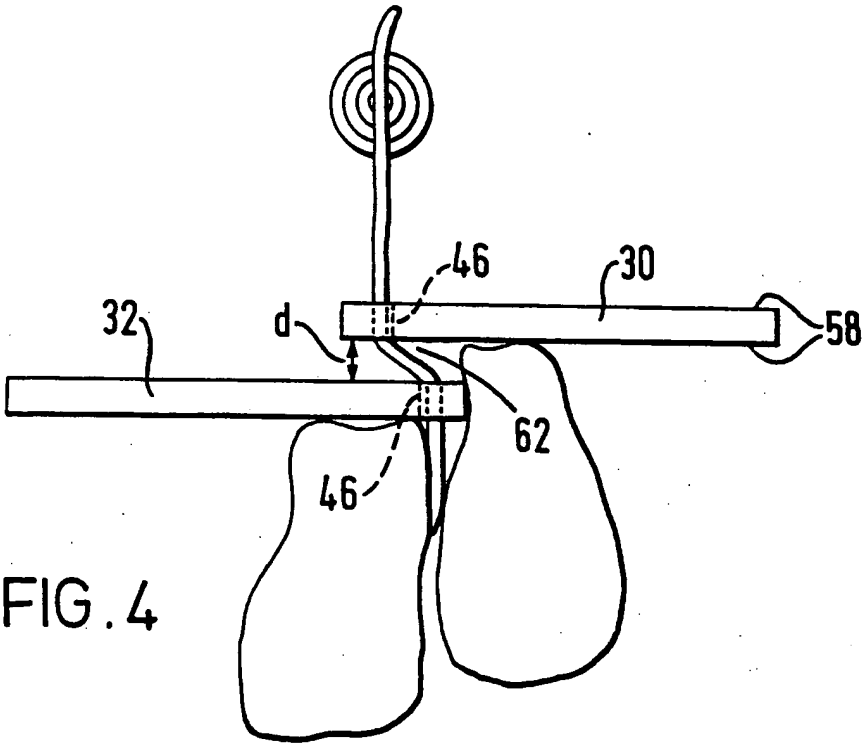



FIG.4

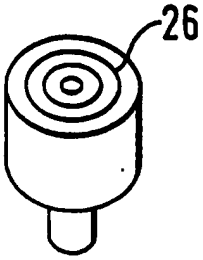



FIG.5a

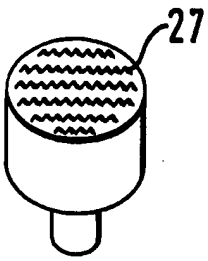



FIG.5b

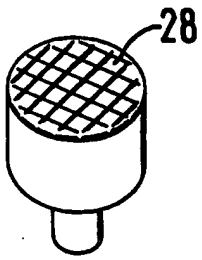



FIG.5c

FIG. 6

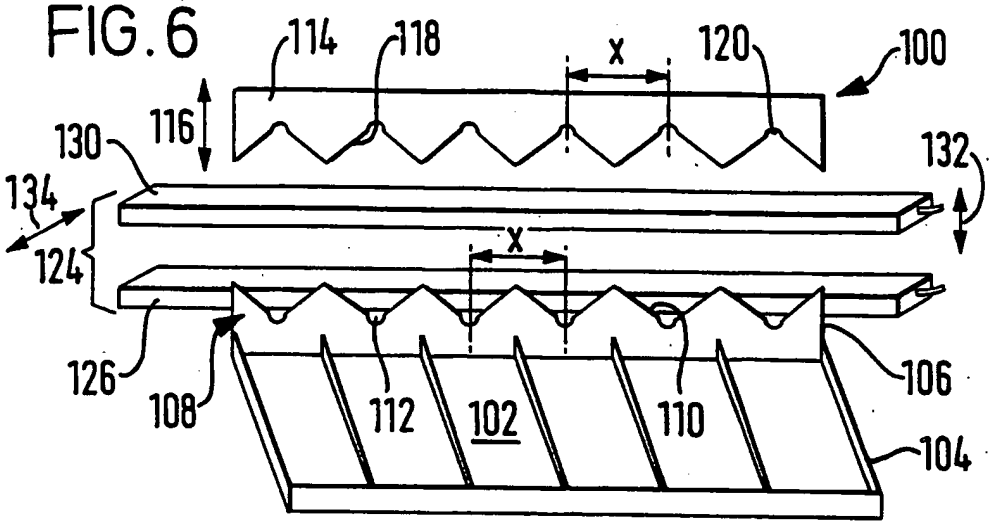
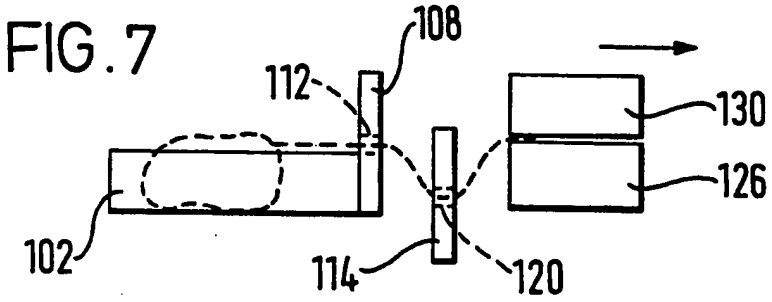



FIG. 7



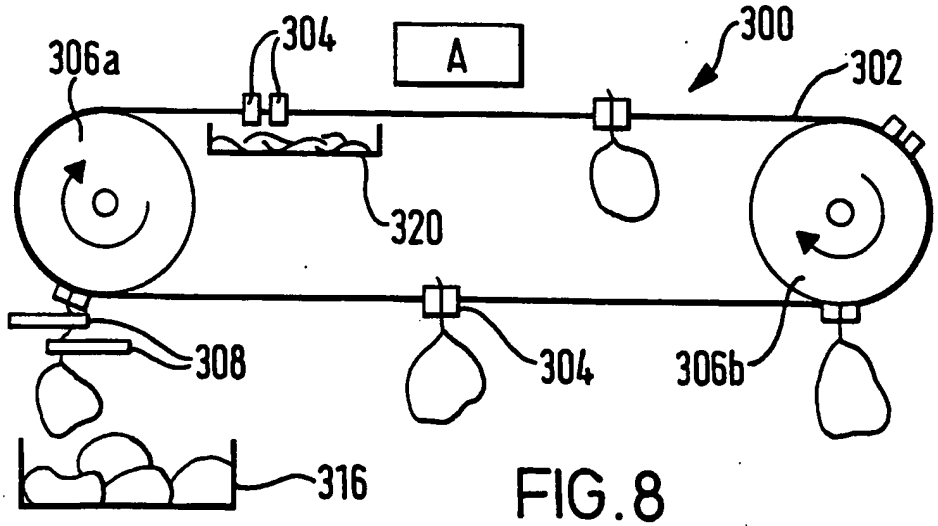
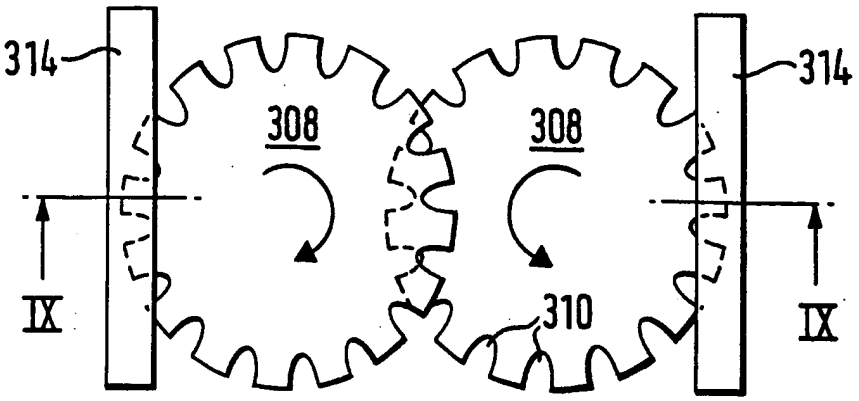




FIG. 8

FIG. 9a



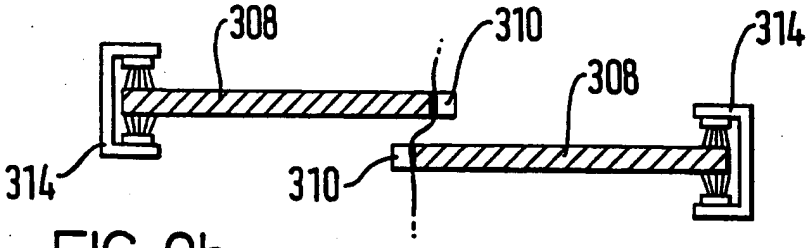




FIG. 9b

FIG. 10

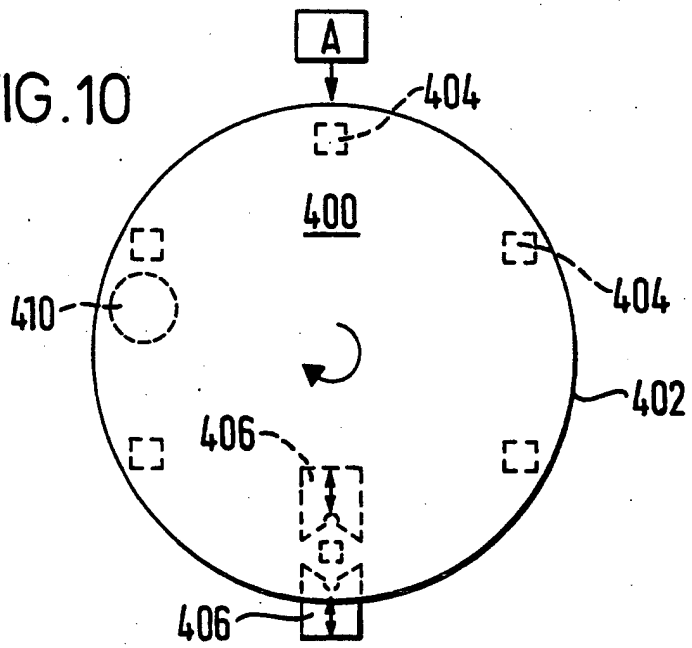


FIG.11

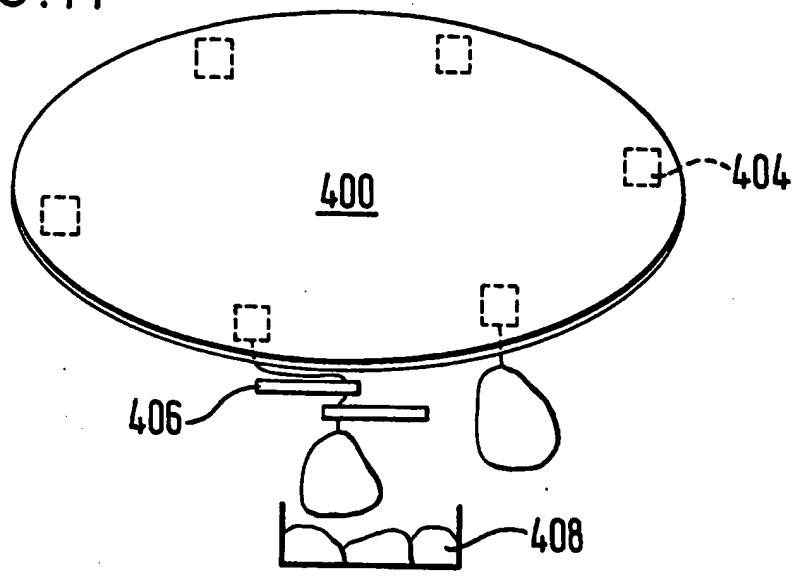
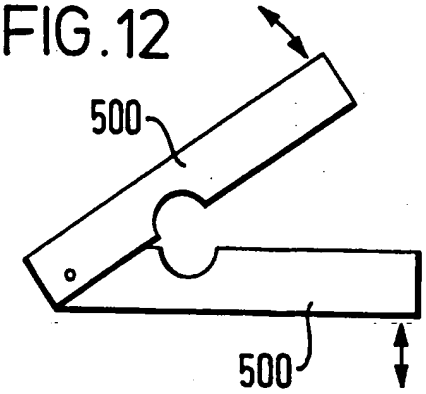



FIG.12



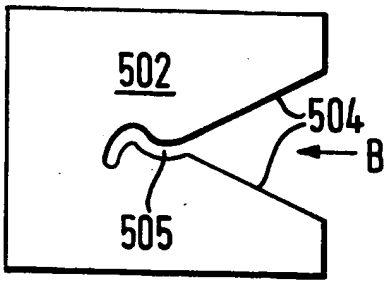




FIG.13

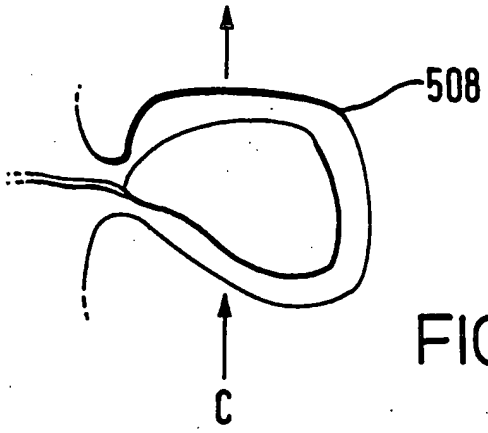



FIG.14

# INTERNATIONAL SEARCH REPORT

Inte: nal Application No
PCT/GB 95/00098

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A22C17/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A22C A22B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 9 March 1995 | 30.03.95 |

| Name and mailing address of the ISA | Authorized officer |
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| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax (+31-70) 340-3016 | De Lameillieure, D |

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PCT/GB 95/00098

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